increasing the general rainfall is probably negligible in the British Isles.

The greater part of the volume is devoted to a question of national importance—the afforestation of water-catchment areas, with particulars of the extent to which the work has already proceeded. This is timely, for the whole question of the water resources of the country is now under investigation by a Committee appointed by the President of the Board of Trade and the Minister of Health. Prof. Henry shows clearly that the gathering grounds for the reservoirs of water supply by gravitation are well fitted in almost every case for planting with timber-trees up to an elevation of 1000 ft., and he adduces some evidence to show that covering a certain proportion of the surface with forest growth, so far from being detrimental to the yield of the areas, is even helpful. Curiously enough, he does not refer to the important influence of high vegetation, and especially of trees, in precipitating moisture from mist, a phenomenon which is shown very strikingly when one is traversing a road through a wood in a thick mist. The road remains perfectly dry, while the drip of water from the branches on either side gives out the sound of abundance of rain, and the ground beneath the trees soon becomes saturated. As Dr. Marloth proved on Table Mountain many years ago, even such inconspicuous growths as a bed of reeds can draw liquid streams from a cloud drifting along mountain slopes which would deposit nothing on a bare stretch of soil or rock. No doubt a certain amount of water is in this way added to a forest-covered catchment area without being recorded in properly exposed rain-gauges.

On the other hand, if, as certain experiments made in Germany and quoted on p. 3 seem to suggest, the transpiration of forest trees is greater than the evaporation from an exposed water surface, the net result may be to reduce the amount of water reaching a reservoir, and this might be a serious matter in a dry summer. Even if we admit that afforestation does not appreciably increase the available run-off, it seems unlikely that it can seriously diminish it, and the balance of probability is that planting a water-catchment area is beneficial. A wide belt of woodland surrounding a reservoir must reduce the wash of surface material into the streams, and so retard the silting up of the reservoir. But, what is more important, the value of the forests when once established will justify the acquisition of the whole drainage area of their water supply by authorities which could not otherwise justify the expense of such a step; and it is only on ground which is the property of the water authorities that it is possible to keep the area free of population or of farm stock, and so secure the water absolutely from all sources of pollution.

This is scarcely the place to criticise the list of catchment areas for water supply in the United Kingdom, which fills 135 pages, and appears to be based on official figures; but one cannot help regretting that the data quoted are not more homogeneous. Rainfall figures, for instance, are given only in some cases, and even then they are often misleading from the lack of information as to how the average was computed. The responsibility for this is on the local authorities themselves, and we can only thank Prof. Henry for his diligence in bringing so many facts together that the room for improvement in the form of statement stares one in the face. No remedy for these ill-assorted statistics can be found until some central water authority comes into existence which can co-ordinate all the local efforts in accordance with one national and scientific system. One slip, however, should be corrected—the allocation of Haweswater to the supply of Penrith on p. 175 and on the map on p. 173. This should be Hayeswater, a small tarn lying between Haweswater and Ullswater.

HUGH ROBERT MILL.

The Wilds of South America.

(1) *In the Wilds of South America: Six Years of Exploration in Colombia, Venezuela, British Guiana, Peru, Bolivia, Argentina, Paraguay, and Brazil.* By Leo E. Miller. Pp. xiv+428. (London: T. Fisher Unwin, Ltd., 1919.) Price 21*s.* net.

(2) *University of Pennsylvania. The University Museum Anthropological Publications.* Vol. ix., *The Central Arawaks.* By William Curtis Farabee. Pp. 288+xxxvi plates. (Philadelphia: The University Museum, 1918.)

(1) MR. MILLER'S well-illustrated book is the attractively written personal narrative of seven exploring expeditions to South America, all but one sent out by the American Museum of Natural History, mainly to collect mammals and birds.

There are few wild countries left which have not been ransacked with the hope that the amassed specimens may include some species "new to science," but there are still fewer the fauna and flora of which have been correlated intelligently with scientific observation of the prevailing environmental conditions. Several American museums stand in the front rank of such enterprises, well planned, with, perhaps, restricted but intense purpose. Mr. Miller, of the American Museum of Natural History, was a member, or the leader, of these expeditions, which from the spring of 1911 to the beginning of 1916 covered an enormous amount of ground: Colombia, in which faunistic paradise alone he spent nearly two years; Venezuela and British Guiana; Bolivia and Argentina; and Roosevelt's famous journey. It is worth noting that our active author finished this book in an aviation concentration camp preparing to "do his bit."

This narrative contains no tedious itineraries. It is a condensed account of, in the aggregate, five years' travelling, with many hundreds of episodes, observations, and reflections, which cover a very wide field, from old churches to local industries, people and scenery, plants and creatures, just as he happened to come across them. There are no blood-curdling incidents, although he had his fair share of danger. Since we are taken through steaming-hot tropical lowland forests, over rivers by raft, canoe, or steam launch, across desert plateaux on to snow-covered mountains, to wild natives and modern towns, a few bare samples or headings must suffice to indicate the range of the work:

A successful search in the highlands of Colombia for the "Cock-of-the-Rock," of which beautiful bird's home life, nest, and eggs little was known. Humming-birds becoming intoxicated with the sap of some tree tapped by woodpeckers. A study of the different modes of feeding of various birds as observed side by side: the parrots climbing to the tip of the fruit-laden branch; the large-billed toucans are enabled to reach a long distance for the coveted morsel, whilst the trogons, with short neck, delicate feet and bill, hover about the fruit. Whilst one river was muddy and potable, another, close by, had clear red water, unfit for drinking, and it contained only a few kinds of fish, but no crocodiles, sandflies, or mosquitoes were about.

Mr. Miller suggests that monkeys may keep the malaria infection alive in districts which, because of this plague, are practically uninhabited by human beings.

In some parts of Bolivia vampires were so common and so little shy that the author was able not only to watch their biting and sucking, but also to sweep them off the mule with a butterfly-net—a feat which frightened the suffering beast so much that it sank to the ground with a groan.

The Sirionó tribe in the same country use bows so powerful that the hunter has to lie down, to grasp it with the feet, and to draw the cord with both hands. They are fierce savages, not "Indios reducidos"—*i.e.* not yet broken and cowed—and no wonder. They had fixed some *protégés* of a mission station to trees by means of numerous long thorns. The padre in turn had seven captives tied to posts, and after four of them had died from starvation and sullenness, the priest took pity upon the remaining three and released them.

As usual, the Indian's mind is rather perplexing. A woman asked the exorbitant price of 4 pesos for a fowl, which she said was a first-class game-cock; when told that the bird was wanted for food only, she at once parted with it for 60 centavos.

On a sandstone plateau, at an elevation of 13,400 ft., was growing the gigantic "Puya," one of the Bromelia family, and humming-birds (*Patagona gigas*) hovered over its numerous flowers.

Monstrous lies grow sometimes from a grain of truth, and so do colossal horned snakes in Brazil. Their size at least is proved by a cunning mixture of circumstantial evidence and further reflection: for instance, the discovery by trustworthy hunters that the so-called horned snakes are really not horned creatures, but such as have swallowed an ox tail foremost, the spreading horns ultimately lodging crosswise in the corners of the mouth—quite a sufficient explanation in countries where anacondas are said to grow to 40 metres in length. But there are also very many observations and valuable reflections by the author himself, frequently concerning the supposed working of natural selection. For example, if the struggle for existence is as keen as is often thought, how can the female insectivorous bat, encumbered with her baby fully three-quarters as large as herself, compete successfully with the unhampered males?

There is also an important account of the cow-bird's (Molothrus) parasitic habits, compared with which those of our own cuckoo seem insignificant, dozens of eggs being dropped into a single nest of the Owen-bird (Furnarius), so that the latter deserts it.—That human curse of the tropics, the plume-hunters, in Paraguay and elsewhere, now scatter poisoned fish over the egret's feeding-grounds during the breeding season.

(2) Mr. Farabee's work on the Arawaks is one of the volumes containing the results of an expedition, from 1913–16, sent to South America by the Museum of the University of Pennsylvania. It deals in detail with the Arawak tribes, their somatic characters, mode of life, traditions and beliefs, ornaments, weapons and other implements. One hundred pages are devoted to the language.

The general account is most interesting reading, but the book is really intended for the specialist.

There are, however, no fewer than thirty-six plates of excellent photographs, notably those which represent the people and their mode of life. The greater number of Arawaks inhabit the savannahs of southern British Guiana and the neighbouring parts of Brazil. The largest of the tribes is that of the Wapisianas, and they number only about 1200. Others amount to fewer than one hundred each, all rapidly decreasing.

Mr. Melville, magistrate and protector of Indians, has lived amongst them for twenty-five years, guarding them from the unscrupulous exploiter. "No traders or missionaries have yet established themselves amongst them, hence their natural honesty, their simple purity, and their primitive religious ideas have not been destroyed."

The author says that the coincidence between our classical and the Wapisiana interpretation of the zodiacal and other constellations is not to be wondered at. To call Orion the warrior is obvious enough. But the Pleiades are "the turtle's nest full of eggs and father of the rains," the beginning of the June wet season. Spica is the corn-planter; Scorpio, the anaconda; and Antares, the scorpion's heart, a red macaw swallowed by the snake. α Cygni is the kingfisher. α and β Centauri are a hunter with his wife.

Life and Temperature.

Action de la Chaleur et du Froid sur l'Activité des Etres Vivants. By Georges Matisse. Pp. ii+556. (Paris: Emile Larose, 1919.)

M. G. MATISSE has brought together in book form researches made by him on the influence of cold and heat on living organisms. He reminds us of the famous experiments of the Abbé Spallanzani, prince of biologists, who showed that dry rotifers could be submitted to temperatures far below zero and up to 62·5° C., and yet return to active life on wetting. Pouchet tells of the strange views which were mooted concerning the death and resurrection of these animals and others experimented upon by Spallanzani, and how Fontana, for fear of the Inquisition, experimented in secrecy, while the Abbé fearlessly published his results and speculations. Spallanzani crushed frozen eggs of insects with the finger-nail and found that small drops of liquid exuded. Life is preserved in this fluid, a "superfusion" of the colloids and electrolytes of protoplasm, the water freezing out. He found seventeen was the greatest number of freezings and thawings which any rotifers, Tardigrades, or Anguillula withstood. Gradual thawing is essential for the preservation of life. Pictet successfully froze and thawed frogs and fish. Spallanzani was the first to sterilise infusions by heat.

M. Matisse recalls Ehrenberg's observations on oscillaria, infusoria, and rotifers living in hot springs in Ischia at 81–85° C.; life in similar conditions, he says, is found in the Yellowstone Park, Wyoming, U.S.A.

We now know that spores of bacteria withstand 100° C. more than sixteen hours, 115° C. from thirty to sixty minutes, and 140° C. one minute. Not only does temperature count, but also time. Claude Bernard found that pigeons and guinea-pigs died in six minutes when put in a dry oven at 90–100° C., rabbits in nine minutes, and dogs in eighteen to thirty minutes. A woman stayed twelve minutes in an oven at 132° C. without being strongly incommoded. Pouchet mentions a man who, at the old Cremorne gardens, walked through a perforated metal tunnel which was surrounded with burning brushwood.

Adaptation to temperature is of considerable interest. Paul Bert found that fish, raised quickly from 12° to 28° C., died, but that, raised slowly 2° C. a day, they survived up to 33° C. Tadpoles, kept a month at 15° C., died at 40·3° C.; others, kept at 25° C., died at 43·5° C. (Davenport and Castle). Snails survive exposure to −110° to −120° C. for weeks. Spallanzani showed that their respiratory exchange and circulation cease entirely in the cold. Protozoa survive −200° C.; bacteria, −250° C. for ten hours (MacFadyean).

Seasonal polymorphism depending on temperature is of interest—*e.g.* aphis is wingless, and reproduces parthenogenetically in the summer; it becomes winged, and male and female in form, with sexual reproduction, in the autumn. Papilio *Vanessa porosa—levana* has spring and summer forms. Salamanders, on the high Alps, are small and black, and have only two young, which are born without branchiæ; those on the plains are large, blotched with yellow, and have many young born with branchiæ. Inversion of the climatic conditions reverses the characteristics of these two forms (Kammerer). Tower submitted Coleoptera (*Leptinotarsa decemlineata*) at the time of formation and maturation of sex elements to 35° C. and dry conditions. The eggs hatched in normal conditions showed eighty-four mutations in the ninety-eight individuals which reached adult age.

A gasteropod, *Lymnea stagnalis,* reproduces its kind in water cooler than 12° C., but the progeny are small. In water at 15–18° C. the progeny are larger. The character of smallness becomes fixed; small individuals transported from cold to warmer water continue to have small progeny (Semper).

The main part of Matisse's book deals with the consideration of the law of van't Hoff and